(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization

International Bureau





(10) International Publication Number WO 2013/014015 A3

(43) International Publication Date 31 January 2013 (31.01.2013)

(51) International Patent Classification:

**B64C 23/06 (2006.01) F03D 11/04 (2006.01)

**F03D 1/06 (2006.01)

(21) International Application Number:

PCT/EP2012/063915

(22) International Filing Date:

16 July 2012 (16.07.2012)

(25) Filing Language:

English

(26) Publication Language:

English

(30) Priority Data:

 11175052.7
 22 July 2011 (22.07.2011)
 EP

 11175051.9
 22 July 2011 (22.07.2011)
 EP

 1202894.0
 21 February 2012 (21.02.2012)
 GB

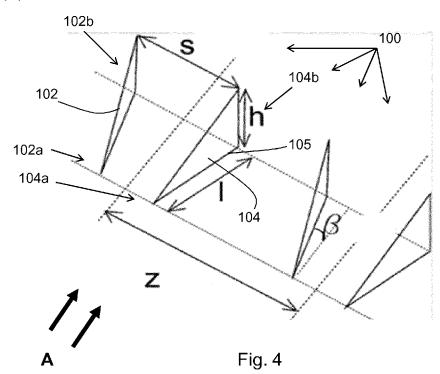
- (71) Applicant (for all designated States except US): LM WIND POWER A/S [DK/DK]; Jupitervej 6, DK-6000 Kolding (DK).
- (72) Inventors; and
- (75) Inventors/Applicants (for US only): WÜRTH, Ines [DE/DE]; (DE). MADSEN, Jesper [DK/DK]; Andsvej 8, DK-6621 Gesten (DK). HANSEN, Rolf [DK/DK]; LM Wind Power A/S, Jupitervej 6, DK-6000 Kolding (DK).

MÜLLER, Olaf [DE/DK]; LM Wind Power A/S, Jupitervej 6, DK-6000 Kolding (DK).

- (74) Agent: KITCHEN, Steven Richard; LM Wind Power A/S, Jupitervej 6, DK-6000 Kolding (DK).
- (81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.
- (84) Designated States (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

[Continued on next page]

(54) Title: A VORTEX GENERATOR ARRANGEMENT FOR AN AIRFOIL



(57) Abstract: A particular arrangement of vortex generators (100) for an airfoil (50) is described. The vortex generators (100) are provided in pairs, preferably on a wind turbine blade (10), wherein by arranging the vortex generators according to specified characteristics, a surprising improvement in blade performance is provided over the prior art systems.



Declarations under Rule 4.17:

 as to the applicant's entitlement to claim the priority of the earlier application (Rule 4.17(iii))

Published:

— with international search report (Art. 21(3))

 before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments (Rule 48.2(h))

(88) Date of publication of the international search report:

2 May 2013

INTERNATIONAL SEARCH REPORT

International application No PCT/EP2012/063915

A. CLASSIFICATION OF SUBJECT MATTER INV. B64C23/06 F03D1/06 F03D11/04 ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

B64C F03D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT
--

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	G. GODARD; M. STANISLAS: "Control of a decelerating boundary layer. Part 1: Optimization of passive vortex generators", AEROSPACE SCIENCE AND TECHNOLOGY, vol. 10, 2006, pages 181-191, XP28033030, cited in the application page 181, column 1 - column 2 page 184, column 1, line 1 - line 6 page 186, column 1 - column 2 table 1 figure 4	1-15

Χ See patent family annex.

- Special categories of cited documents
- "A" document defining the general state of the art which is not considered to be of particular relevance
- "E" earlier application or patent but published on or after the international filing date
- "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- "O" document referring to an oral disclosure, use, exhibition or other means
- document published prior to the international filing date but later than the priority date claimed
- "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
- "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
- "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
- "&" document member of the same patent family

Date of mailing of the international search report

Date of the actual completion of the international search

1 March 2013

Name and mailing address of the ISA/ European Patent Office, P.B. 5818 Patentlaan 2

NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016

07/03/2013

Authorized officer

Lux, Ralph

4

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2012/063915

C(Continua	ation). DOCUMENTS CONSIDERED TO BE RELEVANT	PC1/EP2012/003913
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	JANISZEWSKA ET AL: "THREE DIMENSIONAL AERODYNAMICS OF A SIMPLE WING IN OSCILLATIONINCLUDING EFFECTS OF VORTEX GENERATORS", THESIS, 1 January 2004 (2004-01-01), page 163pp, XP009166811, Retrieved from the Internet: URL:http://etd.ohiolink.edu/send-pdf.cgi/Janiszewska%20Jolanta%20M.pdf?osu1086190848 page 19 - page 20	1-15
A	figure 13 US 2010/008787 A1 (GODSK KRISTIAN BALSCHMIDT [DK]) 14 January 2010 (2010-01-14) paragraphs [0002], [0009], [0013], [0052], [0068], [0123], [0125] figures 3,5,6	1-15
A	US 2008/175711 A1 (GODSK KRISTIAN BALSCHMIDT [DK] ET AL) 24 July 2008 (2008-07-24) paragraphs [0006], [0010], [0022], [0030], [0037], [0041], [0076], [0078] figures 2,4,5,6,13	1-15

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/EP2012/063915

Patent document cited in search report		Publication date	Patent family member(s)		Publication date	
US 2010008787	A1 14-01-2	14-01-2010	AT	490404	T	15-12-2010
			CN	101680423	Α	24-03-2010
			DK	2129908	T3	21-03-2011
			EP	2129908	A2	09-12-2009
			ES	2358881	T3	16-05-2011
			US	2010008787	A1	14-01-2010
			WO	2008113350	A2	25-09-2008
US 2008175711	A1	24-07-2008	CN	101223356	Α	16-07-2008
			EP	1886016	A1	13-02-2008
			US	2008175711	A1	24-07-2008
			WO	2006122547	A1	23-11-2006